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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,185	03/31/2004	Thomas J. Fitzgerald	884.C29US1	7205
21186	7590	06/09/2005	EXAMINER	
SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A. P.O. BOX 2938 MINNEAPOLIS, MN 55402-0938			BEREZNY, NEMA O	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 06/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/815,185

Applicant(s)

FITZGERALD ET AL.

Examiner

Nema O. Berezny

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-57 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 18-20,22-44 and 46-57 is/are rejected.
- 7) ☒ Claim(s) 21 and 45 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 18-41 in the reply filed on 4-1-05 is acknowledged. Cancellation of claims 1-17 is acknowledged. Claims 18-57 are currently pending.

Claim Objections

Claim 31 is objected to because of the following informalities: claim 31 depends from cancelled claim 12. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 27 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Said claim requires the second gas to be less reactive than the first gas. However, there is no prior claimed first gas.

Claim 55 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is uncertain what is being isolated from what in lines 2-3.

Claim 27 recites the limitation "the first gas" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 34, 37-38, and 41 are rejected under 35 U.S.C. 102(b) as being anticipated by IBM Technical Disclosure Bulletin (TDB) (NN79034125). TDB '125 discloses a method comprising: attaching at least one die (el.9) to a substrate (no #); placing a thermally conductive heat spreader (el.10) over the die; and interposing a molten metal material (el.13) between the thermally conductive heat spreader and the die (see figure) **[claim 34]**. TDB '125 also discloses cooling the molten metal material after the space between the at least one die and the thermally conductive heat spreader was filled with the molten metal material (disclosure text, p.2) **[claim 37]**; pressurizing the molten metal material (disclosure text, p.1) **[claim 38]**; and adding a wetting layer to at least one surface in the space between the die and the substrate (disclosure text, p.1) **[claim 41]**.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 18-20, 22-24, 33, 42-44, and 46-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over IBM Technical Disclosure Bulletin (TDB) (NN79091553) in view of Huang et al. (2002/0180035). TDB '553 discloses a method comprising: attaching a die (el.2) to a substrate (el.3); providing a thermally conductive heat spreader (el.5); and flowing a molten metal material (el.6) into contact with the thermally conductive heat spreader and the die (see figure). However, TDB '553 does not disclose providing a mold. TDB '553 would look to one such as Huang for device protection because Huang discloses heating a mold, which is implied with a molding process; and placing the heat spreader and substrate into the mold (p.3 para.36). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the mold of Huang with the method of TDB '553 in order to form a protective encapsulant around the structure **[claims 18, 42]**.

Based upon the rejection of claims 18 and 42 above, TDB '553 also discloses placing a pressure on the molten metal material (implied in disclosure text, p.1) **[claims 23, 50]**; wherein placing a pressure on the molten metal includes maintaining a pressure substantially during flowing a molten material (implied in disclosure text, p.1) **[claim 24]**; and wherein flowing a molten metal material into contact with the heat

spreader and the die includes filling the space between the heat spreader and the die (see figure) **[claim 47]**.

Based upon the rejection of claims 18 and 42 above, TDB '553 does not disclose underfilling or encapsulating the die, cooling a mold, adding another component to the substrate, or covering the electrical contacts between the die and the substrate. However, TDB '553 would look to one such as Huang for device protection, curing an encapsulant, and forming a multi-chip module (MCM) because Huang discloses the following.

Huang discloses cooling a mold and a thermally conductive heat spreader (implied in a molding process). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the mold cooling of Huang with the method of TDB '553 in order to cure the protective encapsulating material **[claims 22, 46]**.

Huang discloses underfilling the space between the die and the substrate (Fig.3), and encapsulating (el.34) the die. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the underfilling and encapsulating of Huang with the method of TDB '553 in order to protect the device from moisture and contaminants **[claims 19, 20, 43, 44]**. Huang also discloses adding at least one other component to the substrate (Fig.2C), and underfilling (Fig.3) and encapsulating said other component (Fig.2E). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the other

component of Huang with the method of TDB '553 in order to form a MCM **[claims 33, 52, 53, 54]**.

Huang discloses covering a plurality of electrical contacts between the die and the substrate with a material that is stable in the presence of the molten metal (Fig.3). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the covering of Huang with the method of TDB '553 in order to protect the device from moisture and contaminants **[claims 48, 49, 51]**.

Based upon the rejection of claims 42 and 52 above, TDB '553 discloses isolating a plurality of electrical contacts between the die and the substrates other component from the molten metal; and isolating a plurality of electrical contacts between the other component and a surface to which the other component is attached from the molten metal (see figure) **[claim 55]**.

Claims 35-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over TDB '125 as applied to claim 34 above, and further in view of Satoh et al. (5,276,289). TDB '125 does not disclose attaching or stacking a second die. However, TDB '125 would look to one such as Satoh for additional chip capacity and efficient spacing because Satoh discloses attaching a second die onto the substrate (Fig.8), and stacking a second die onto the at least one die attached to the substrate (Fig.8). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the second die of Satoh with the method of TDB '125 in order to

provide additional chip capacity on the same substrate **[claim 35]**; and to provide more efficient chip packaging by occupying less space on the substrate **[claim 36]**.

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over TDB '125 as applied to claim 34 above, and further in view of Huang et al. (2002/0180035). TDB '125 does not disclose underfilling said die. However, TDB '125 would look to one such as Huang for device protection because Huang discloses underfilling the space between the die and the substrate (Fig.3). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the underfilling of Huang with the method of TDB '125 in order to protect the device from moisture and contaminants.

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over TDB '125 as applied to claim 34 above, and further in view of Werkhoven et al. (2003/0129826). TDB '125 does not disclose removing molten metal material from a vessel. However, TDB '125 would look to one such as Werkhoven for preventing contamination because Werkhoven discloses removing the molten metal material from a portion of a vessel that is not exposed to the atmosphere (p.11 para.126). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the removing of Werkhoven with the method of TDB '125 in order to prevent contamination of subsequent chamber processing.

Claims 31-32 and 56-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over TDB '553 in view of Huang as applied to claims 18, 42, and 52 above, and further in view of Satoh et al. (5,276,289). TDB '553 and Huang do not disclose stacking a second die to said first die or attaching a second die to the substrate. However, TDB '553 and Huang would look to one such as Satoh for additional chip capacity and efficient spacing because Satoh discloses attaching a second die onto the substrate (Fig.8), and stacking a second die onto said first die (Fig.8). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the stacking and attaching of Satoh with the method of TDB '553 in order to provide additional chip capacity on the same substrate **[claim 57]**; and to provide more efficient chip packaging by occupying less space on the substrate **[claims 31, 56]**.

Based upon the rejection of claim 31 above, TDB '553 and Satoh do not disclose encapsulating the first and second dice. However, TDB '553 and Satoh would look to one such as Huang for device protection because Huang discloses encapsulating (el.34) the die. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the encapsulating of Huang with the method of TDB '553 and Satoh in order to protect the device from moisture and contaminants **[claim 32]**.

Claims 25 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over TDB '553 and Huang as applied to claim 18 above, and further in view of Tonti et

al. (5,773,362). TDB '553 and Huang do not disclose removing reactive components or adding a wetting layer. However, TDB '553 and Huang would look to one such as Tonti for improved heat dissipation because Tonti discloses removing reactive components from the space between the die and the thermally conductive heat spreader. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the removing of Tonti with the method of TDB '553 and Huang in order to improve heat dissipation (col.3 lines 22-30) **[claim 25]**. TDB '553 and Huang would also look to one such as Tonti for improved heat dissipation because Tonti discloses adding a wetting layer (Fig.6 el.62) to at least one of the surfaces associated with the space between the substrate and the thermally conductive heat spreader. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the wetting layer of Tonti with the method of TDB '553 and Huang in order to improve heat transmission (col.4 lines 59-64) **[claim 30]**.

Claims 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over TDB '553, Huang, and Tonti as applied to claims 18 and 25 above, and further in view of Weaver et al. (2002/0096508). TDB '553 discloses wherein removing reactive components from the space between the die and the thermally conductive heat spreader further includes: initially drawing a vacuum on the space between the die and the thermally conductive heat spreader (disclosure text). However, TDB '553, Huang, and Tonti do not disclose purging the space between the die and heat spreader. TDB '553, Huang, and Tonti would look to one such as Weaver for nonreactive components

because Weaver discloses purging the space between the die and the thermally conductive heat spreader with a second gas, wherein the second gas is an inert gas and is less reactive than a first gas (p.7 para.67). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the purging of Weaver with the method of TDB '553, Huang, and Tonti in order to remove contaminants from die and heat spreader surfaces with a nonreactive component **[claims 26, 27, 29]**.

Based upon the rejection of claim 26 above, TDB '553 discloses drawing a second vacuum on the space between the die and the thermally conductive heat spreader **[claim 28]**.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter for claims 21 and 45: the prior art of record does not teach or disclose or make obvious the method of claims 18 and 42, comprising inter alia: flowing a molten metal material through a gate in the mold and a gate in the thermally conductive heat spreader. TDB '553 discloses that the liquid metal between the heat sink and die is assembled in the solid state and then becomes liquid from the heat of the operating chip. Therefore, it would not be obvious to combine the structure of TDB '125, which comprises a gate in the heat sink, with the structure of TDB '553 since molten metal material is not fed into the structure of TDB '553. TDB '125 by itself does not disclose said allowable claims because the liquid metal is not in contact with the die or heat sink.

Claims 21 and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O. Berezny whose telephone number is (571) 272-1686. The examiner can normally be reached on M-F 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NB

A handwritten signature in black ink, appearing to read "Laura M. Kelly". The signature is fluid and cursive, with a large loop at the end of the last name.